

4 The price of toxicity. Methodology for the assessment of shadow prices for human toxicity, ecotoxicity and abiotic depletion

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Abstract

Weighting of environmental impacts is necessary to arrive at a single environmental indicator. One of the methods to weigh impacts, which has been operationalised for a number of impact categories in the Netherlands, is known as the shadow price method, using the highest acceptable costs for mitigation measures as a weighting factor. Up to now, no shadow prices were available for the more complex and less documented Environmental Impact Categories (EICs) in the field of human toxicity, ecotoxicity and depletion of abiotic materials. Therefore, a method was developed and applied to assess the shadow prices of these EICs. It consists of four steps: (1) characterising current environmental policy; (2) concentrating on the most relevant substances; (3) collecting abatement cost data and (4) calculating the shadow price.

The paper describes the method, discusses the results and concludes by presenting the full set of shadow prices in the Netherlands for the ten EICs of the CML-2 method. They are ready to be applied in the assessment of environmental profiles and the evaluation of measures in cost-benefit analysis, according to present policy preferences. We show that the external

costs of the toxicity impact categories are, on average, substantial compared to those of the EICs for which shadow prices had already been established.

4.1 Introduction

The lack of comparability of environmental impacts poses a problem to investors, designers and not least to environmental policy-makers. It is hard to decide which appliance is more environmentally friendly: the ozone-depleting high-efficiency fridge or the ozone-friendly but more power-hungry fridge. In such cases, environmental impacts need to be weighed. One of the methods to do this is known as the shadow price method. It uses the highest acceptable costs for mitigation measures as a weighting factor and has been operationalised for a number of impact categories in the Netherlands. For instance, the Dutch Ministry of Public Works uses the shadow price method in combination with the life cycle assessment method called CML-2 (introduced by the Leiden University Institute of Environmental Sciences)(Guinée et al. 2001) in their life cycle impact assessment model DuboCalc to calculate the environmental impact of infrastructure works (Davidson and Wit 2003). The advantage of using shadow prices is that different environmental impacts are translated into external costs that can be compared with each other and with the internal production costs. The danger, of course, is that certain intrinsic values are underappreciated and get lost in the total cost analysis.

Several sets of shadow prices have been assessed, mainly for near-future targets of well-documented Environmental Impact Categories (EIC) such as climate change, acidification, ozone depletion, tropospheric ozone formation and eutrophication, e.g. by the organisations CE0, NIBE (Twin) and TME (KPMG Sustainability and CE 2002; NIBE Research 2002; Jantzen 2002). Internationally, the shadow price of CO₂ is also often referred to as the price of CO₂ on the emission trading market or the marginal reduction costs of national climate policies. However, shadow prices have so far not been available for the depletion of abiotic materials (ADP) and the toxicity-related categories (human toxicity potential – HTP, marine aquatic and sediment ecotoxicity potential – MAETP and MSETP, fresh-water aquatic and sediment ecotoxicity potential – FAETP and FSETP, or terrestrial ecotoxicity Potential – TETP). ADP relates to natural